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ABSTRACT

A study researched the differential uses readers make of analogic and visual prompts for understanding and remembering complex prose. Fifty-two eleventh grade students with average and above average reading ability enrolled in a comprehensive high school in central Georgia participated in the study. They were ranked according to their ability to learn from reading and assigned to one of four groups, which corresponded to guide material that was different for each treatment condition. The reading material described the game of cricket, but two of the guides provided analogies between cricket and baseball and two provided diagrams. The study was done in two phases: in phase one the students read the material, completed the study guide, and took a 20-item sentence completion test on the game of cricket; in phase two the students took the same test again at a later time. Mean averages and standard deviations were computed for each treatment group's immediate and delayed test results. Both analogies and diagrams contributed substantially to the students' initial understanding of the material, but the delayed test showed that the analogy groups retained their understanding better and longer. Providing readers with visual aids to prompt initial integration of novel information and analogies to help them retain it stands as a theoretically defensible teaching practice supported by the finding of this and other related investigations. (SRT)

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Readers' Use of Analogic and Visual Aids for Understanding and Remembering Complex Prose

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Readers' Use of Analogic and Visual Aids for
Understanding and Remembering Complex Prose

The research reported here attempted to sort out the differential uses readers make of analogic and visual prompts for understanding and remembering complex prose. By understanding how readers use such prompts, teachers stand to make more effective use of the texts which they have students read as part of their instruction. The research focused on prompts which were analogical and visual because reading is essentially an analogical and visual act.

If it is accepted that reading is forming thought about the referents of signs marked on a surface, then it must also be accepted that analogizing and visualizing are basic in ordinary reading. It is by analogy that the signs of a text are taken to represent their referents. And it is by analogy that these representations are organized into coherent lines of thought. Readers perceive the signs visually and interpret their referents to a significant extent as visual images. To comprehend texts and learn from them, readers may organize images produced in reading so that they correspond to placeholders in analogy statements (as in patterns such as A:B::B:C, A:B::C:D, etc.). Readers' success in forming useful image structures may well depend upon the availability of certain devices in the text to prompt them.

If the text is complex, illustrative devices may help readers meet particular comprehension and memory demands. If gaining spatial orientation is needed, visual aids such as pictures and diagrams may help (Dean & Kulhavy, 1981; Dean & Enemoh, 1983). If remembering the material is called for, analogies may help (Hayes & Tierney, 1982; Honeck, Reichmann, & Hoffman, 1975). If readers' demands are both spatial and mnemonic, a combination of visual and analogic devices might prove helpful (Mayer, 1975; Rigney & Lutz, 1976; Royer & Cable, 1976; Gick, 1985).

In a number of experiments Hayes and Henk (1983, 1984, in press) compared high school students' use of analogic and pictorial illustrations provided them in a text describing how to tie the bowline knot. In the no-analogy condition of those experiments students given pictures viewed simple line drawings depicting the steps of tying the bowline; in the analogy condition, students given pictures viewed a sequence of cartoon drawings which depicted the steps of tying the bowline by likening them to the movements of a fictional rabbit guarding his premises. The dependent variable was number of correct manipulations completed toward forming the bowline knot. To test the mnemonic value of the analogies and pictures, after an interval of two weeks the students were evaluated on their attempts to tie the bowline knot from memory. The pictures proved helpful for both immediate and delayed performance, though much less so for the delayed performance. Students found the analogy somewhat helpful

for immediate performance, but very helpful for remembering how to tie the bowline after an interval of two weeks.

Because readers in those studies were observed applying a manual task, its findings may be limited to reading texts on similar procedural tasks. It may be that readers do not use analogic and visual aids in the same way when reading texts for other purposes. Students in school are seldom asked to read for the purpose of performing manual procedures. Most of their reading is attended by other verbal activity such as writing, discussing, and taking written tests of the material read. And any comparisons they encounter in reading are far more likely to present literal similarities than figurative similarities.

The lack of analogic and visual aids in particular text presentations places another limitation on the practical significance of the previous research. Although analogies are distributed widely in textbooks (Curtis & Reigeluth, 1984), their appearance is not extensive in many textbooks and practically nil in some. The appearance of pictorial analogies is fairly uncommon. Curtis and Reigeluth (1984) reported that no more than 16% of the analogies they found in textbooks were pictorial analogies. Alesandrini (1985) reported that 2% of the pictures she found in chemistry books she surveyed were analogic, but that there were no such pictures in any other textbooks she inspected. If students are to have these kinds of study aids available when they would likely prove helpful, for some texts

teachers may have to incorporate them in adjunct guide material (Bean, Singer, & Cowan, 1985).

The present experiment was designed to take account of the aforementioned practical matters not addressed by the previous research. Rather than present students with texts variously augmented by analogic and visual aids, a single unembellished text was used; and more in keeping with actual school practices, students were given study guide material to help them learn from the text. The focus, then, was on the students' use of the guide materials which incorporated analogies and visual aids.

Method

Subjects

Participants in the study were 52 eleventh grade students enrolled in a comprehensive high school in central Georgia. The students were judged by their English teacher to be within the average range of reading ability or higher among eleventh grade students in that school. The students were ranked by the teacher according to his judgment of their ability to learn from reading, and on the basis of that ranking they were then assigned to one of four groups. This resulted in four comparable treatment groups (n=13) for the study.

Materials

The instructional text of the experiment was an 800-word prose description of the game of cricket, a game unfamiliar to the students yet analogous to the popular American game of baseball. The text contained no analogies or visual aids.

To accompany the instructional text four sets of guide material were developed, one for each treatment condition. All of the guides were constructed so as to direct students' attention to the same features of the game of cricket (an overview of the game and its object, the playing field, scoring, the pitch as the center of the game's activity, the role of the bowler, the role of the batsmen and nonstrikers, turns at bat). Two of the guides were constructed so as to direct students' attention to these game features without making comparisons to other games. These were the guides constructed for the two no-analogy groups. One of these no-analogy guides was augmented with a diagram of the playing field, whose areas students were directed to label. Two other guides were constructed so as to direct students' attention to points of correspondence between the games of cricket and baseball. These were the guides constructed for the two analogy groups. One of these guides was augmented by a pair of diagrams, one representing the playing field for cricket and the other the playing field for baseball. Placed on the page side by side, the diagrams showed the two games' corresponding areas of play with the use of arrows.

Procedure

In order to make a differential determination of readers use of the guide materials for immediate understanding of the novel content and for remembering it over time, data were collected on two occasions separated by an interval of two weeks. In phase I students attempted to learn about the game of cricket. In phase II they were called upon to demonstrate how much they could remember about cricket.

Phase I. The students were given the instructional text on the game of cricket and an accompanying study guide according to treatment group assignment. Ample time was allowed for students to read carefully the instructional text and complete the study guide. After about 25 minutes the instructional texts and completed study guides were collected and the students were issued a 20-item sentence completion test on the game of cricket.

Phase II. Two weeks later the students were given the same test again. There was no previous mention that the test would be administered again. No material was made available for students to study, and there was no review of the previously presented material.

Results and Discussion

Mean averages and standard deviations were computed for each treatment group's immediate and delayed test results. These statistics are summarized in Table 1. A comparison of

the group's performance on the immediate test shows that both analogies and diagrams contributed substantially to the students' initial understanding of the material. Here the diagrams made a slightly greater contribution to readers' initial understanding than did the analogies. Comparison of the groups' performance on the delayed test shows, however, that the initial advantage gained from the diagrams was lost over the two week interval. In sharp contrast, students in the analogy groups maintained well their relative advantage.

In general the results indicate that the value of analogic and visual aids previously observed for understanding and remembering written instructions for completing a manual procedure (Hayes & Henk, 1983, 1984, in press) also hold for understanding and remembering text information encountered in a study task resembling study tasks ordinarily assigned in school. In the experiment, students used both analogies and diagrams to help them comprehend and remember radically new material. Apparently the diagrams were used initially to sort through its complexity and place novel information in a comprehensible scheme. Analogies may also have been used in this way during the initial phase of the experiment. But the distinct advantage students appear to have made of the analogies was to use them for fashioning a format for remembering how the information fit together. The analogies' literal comparisons were no less effective than were figurative comparisons in previous experiments. Whereas in the present as well as in previous investigations

analogies were shown to be aids to memory, a mnemonic function has not similarly been found for visual aids.

The findings are consistent with Kaufmann's (1985) theory of symbolic problem solving, according to which thinking is immanent and constituted in symbolic expression. Concepts are regarded as capacities exercised in acts of judgment within categories of events. These acts of judgment are implemented through symbols of language and imagery. Because language can account for the discursive and propositional character of thinking, language is held to be the basic symbolic instrument. Developing out of auditory imagery through the formation of phoneme patterns which are analogical in structure and application, verbal symbolism is inexorably linked with auditory perception. Similarly as in auditory perception temporally and sequentially organized stimulus patterns are dealt with, the verbal symbolic system functions to organize information sequentially. Serving a very different purpose, visual imagery functions as an integrator of information, particularly during the initial phase of confronting novelty.

To construe this theory to the case of reading, representation through visual images occurs in initial encounters with novel and complex content, when its details must be integrated to be made comprehensible. But it is through verbal symbolism that subsequently a sequential

organization of details can take place to allow for their examination and for the making of general rules. It would appear then that providing readers visual aids to prompt initial integration of novel information and analogies to help them structure that information for subsequent analysis stands as a theoretically defensible teaching practice supported by the findings of this and other related investigations.

Table 1

Means and Standard Deviations for Cricket Test Performance

	Time of Performance			
	Phase I (Immediate Performance)		Phase II (Delayed Performance)	
Group[a]	$\bar{X}$	(SD)	$\bar{X}$	(SD)
No Analogy				
Prose Only	12.38	(4.20)	5.46	(3.25)
Prose & Diagram	15.15	(5.23)	6.23	(3.43)
Analogy				
Prose Only	13.77	(4.97)	9.85	(4.33)
Prose & Diagram	15.62	(4.67)	9.69	(3.97)

[a]N = 13 per group

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